

भारतीय मानक
Indian Standard

IS 6044 (Part 1) : 2018

**द्रवीय पेट्रोलियम गैस भंडारण स्थापना —
रीति संहिता**

**भाग 1 आवासीय, वाणिज्यिक और
औद्योगिक सिलेंडर स्थापना
(तीसरा पुनरीक्षण)**

**Liquefied Petroleum Gas Storage
Installations — Code of Practice**

**Part 1 Residential, Commercial and
Industrial Cylinder Installations
(Third Revision)**

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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1971 and subsequently revised in 2000 and 2013. In this revision the following major changes have been made:

- a) Cylinder location, cylinder manifolds, pressure regulators and piping, tubes and fittings have been modified;
- b) A new Annex A has been added to include requirements of liquid off take valve multi cylinder installation; and
- c) Other technical changes for better implementation of this standard.

While implementing this standard, compliance with statutory regulations shall be ensured.

The composition of the Committee responsible for the formulation of this standard is given in Annex B. For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LIQUEFIED PETROLEUM GAS STORAGE INSTALLATIONS — CODE OF PRACTICE

PART 1 RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CYLINDER INSTALLATIONS

(*Third Revision*)

1 SCOPE

1.1 This standard (Part 1) lays down the requirements for the installations of liquefied petroleum gas (LPG) cylinders for vapour and/or liquid withdrawal from cylinders, the associated piping and equipment in residential, commercial and industrial premises, where cylinder manifold is provided for installation capacity up to 8 000 kg.

1.2 The specific requirements for installation of liquid withdrawal from cylinders are covered in Annex A.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No</i>	<i>Title</i>
383 : 2016	Coarse and fine aggregate for concrete — Specification (<i>third revision</i>)
1239 (Part 1) : 2004	Steel tubes, tubulars and other wrought steel fittings — Specification: Part 1 Steel tubes (<i>sixth revision</i>)
2379 : 1990	Pipelines — Identification — Colour (<i>first revision</i>)
2501 : 1995	Solid drawn copper tubes for general engineering purposes — Specification (<i>third revision</i>)
2878 : 2004	Fire extinguisher, carbon dioxide type (portable and trolley mounted) — Specification (<i>third revision</i>)
3043 : 1987	Code of practice for earthing (<i>first revision</i>)
3601 : 2006	Steel tubes for mechanical and general engineering purposes — Specification (<i>second revision</i>)

IS No

Title

4576 : 1999	Liquefied petroleum gases — Specification (<i>second revision</i>)
6044 (Part 2) : 2001	Code of practice for liquefied petroleum gas storage installations: Part 2 Commercial, industrial and domestic bulk storage installations (<i>first revision</i>)
7241 : 1981	Glossary of terms used in gas cylinder technology (<i>first revision</i>)
9573 (Part 1) : 2017	Rubber hose for liquefied petroleum gas (LPG) — Specification: Part 1 Industrial application (<i>fourth revision</i>)
9573 (Part 2) : 2017	Rubber hose for liquefied petroleum gas (LPG) — Specification: Part 2 Domestic and commercial application (<i>fourth revision</i>)
15683 : 2006	Portable fire extinguishers — Performance and construction — Specification
16484 : 2017	Liquid off-take valve fitting to gas cylinders or tanks (mobile or static) for liquid petroleum gas (LPG) — Specification

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 7241, and the following shall apply.

3.1 Installation — A designated premises in an establishment where the complete multi cylinder system comprising of cylinder, valve fittings, piping, manifold, vapourisers, pressure regulating station etc, is installed.

3.2 Header and Manifold — A header is the main pipe of an installation, that serves as a central connection for other manifolds. Manifold is a branched pipeline of header provided with suitable pipe fittings for individual cylinders.

3.3 Distribution/Distributing Company — The company which is in the field of marketing LPG and is owner of the cylinders.

IS 6044 (Part 1) : 2018

3.4 Statutory Authority — The Authority designated under *Gas Cylinder Rules*, 2016 for approving LPG cylinders, valves and regulators.

3.5 Authorized Agency — Person or agency or a corporate body authorized by distribution company to execute the job of designing, erection, testing and maintenance of multi cylinder installation.

4 GENERAL RECOMMENDATIONS

4.1 The system shall be installed by an authorized agency. The Authorized Agency shall have trained manpower that is well versed with the characteristics of LPG and is trained in good practice of handling, installing, testing and maintaining installations.

4.2 The system shall be installed in line with the requirements of this standard shall conform to the layout approved by the distributing company or by any other statute as applicable.

4.3 The maintenance, inspection, testing, repair, etc, of the system shall be carried out by agencies authorized by the distribution company.

4.4 Cylinders and valve fittings shall comply with the relevant Indian standard and shall be approved by the Statutory Authority. All other equipment such as pressure regulators and other installation material shall conform to the relevant Indian Standard or any other equivalent international standards. For LPG lines, threaded joints shall not be provided except for special fittings like excess flow check valve, thermal relief valves (TRV), pressure gauges etc.

4.5 Point of Delivery

Location of cylinder bank and point of delivery of LPG cylinders shall be acceptable to the distributing

company. Proper motor able approach to the point of delivery shall be provided for ease in delivery/ receipt of filled/empty cylinders through vehicles. The approach is also required to provide free access to fire tender and firefighting personnel in case of any emergency.

The access route to the point of delivery must be firm and compact even in wet conditions and adequate space must be provided for parking of cylinder truck making delivery of cylinders.

The distance from point of delivery to cylinder bank should not be more than 75 m and the path should firm and compact even in wet condition and minimum 600 mm wide for easy movement of cylinder trolley.

4.6 The colour coding of LPG liquid and vapour lines shall be as per IS 2379. The colour coding shall be clearly stated on an instruction board provided in the shed and also at the main office. The direction of flow shall be indicated on the pipeline with black colour paint.

4.7 Fire extinguishers of powder type (*see* IS 15683) or carbon dioxide (*see* IS 2878) type or stored pressure Type A, B, C (*see* IS 15683) shall be provided in places where LPG cylinder installations are situated and shall be located near such installations. The installations with multi manifolds above 2000 kg and up to 4000 kg shall have either water sprinkler system or gas monitoring system with local as well as remote alarm system. Two buckets filled with sand and two with water shall be provided nearby. Installation above 4000 kg to 8000 kg shall have both water sprinkler as well as gas monitoring system. In addition, for installations above 2000 kg, following shall be applicable (the number, type, sizes of the fire extinguishers):

SI No.	Capacity of LPG Installations	Number of Fire Extinguisher	Type	Capacity in kg
i)	For installations with LPG 40 kg to 200 kg	2	Dry powder	10
ii)	For installations with LPG more than 200 kg and up to 320 kg	3	Dry powder	10
iii)	For installations with LPG more than 320 kg and up to 1 000 kg	4	Dry powder	10
iv)	For installations with LPG more than 1 000 kg	2 numbers for each additional 1 000 kg or a fraction thereof.	Dry powder	10

NOTE — For electrical installation 1 No. carbon dioxide (CO₂) (4.5 kg capacity) fire extinguisher shall be provided.

4.7.1 Gas Monitoring System (GMS) Configuration

4.7.1.1 For LPG installations from 2 000 kg and up to 4 000 kg

One sensor at each corner of shed shall be provided. The sensors shall be provided within 3 m from nearest cylinder of manifold.

4.7.1.2 For LPG installations beyond 4 000 kg and up to 8 000 kg

In addition to 4.7.1.1, two additional sensors shall be provided. The additional two sensors shall be located in middle of each of the longer sides of the shed.

4.8 Safety cap shall be put on all cylinders when not in use, whether empty or filled with gas. Storage of filled cylinders shall be as per statutory requirement.

4.9 The installation shall have caution signs such as 'LPG', 'DANGER', 'HIGHLY INFLAMMABLE GAS', 'NO SMOKING', etc, painted in luminous red paint, outside at a prominent place.

5 CYLINDER LOCATION

5.1 Stationary Installations

5.1.1 Stationary installation not exceeding 50 kg of LPG may be installed indoor on any floor. It is recommended to have a minimum floor area of 5 m² for such an installation.

5.1.2 Stationary installations each not exceeding 50 kg of LPG may be installed indoors on any floor and within the same workspace provided the minimum distance between two such installations is 3 m. The proportion of such installations to floor area is one installation per 5 m² and the aggregate quantity of gas of all such installations does not exceed 200 kg.

5.1.3 Stationary installation not exceeding 100 kg of LPG may be installed indoor on any floor provided the floor area for such an installation is not less than 12 m².

5.1.4 Stationary installations each not exceeding 100 kg of LPG may be installed indoor on any floor and within the same workspace provided the minimum distance between two such installations is 3 m. The proportion of such installations to floor area is one installation per 12 m² and the aggregate quantity of gas of all such installations does not exceed 200 kg.

5.1.5 Stationary installation not exceeding 400 kg of LPG may be installed indoors in an enclosed section of a building or a room reserved exclusively for this purpose and ventilated at low level directly to the outside air.

5.1.6 Stationary installations above 400 kg (200 kg in case provision as given in 5.1.5 is not possible) but not exceeding 1 000 kg shall be installed outdoors on

ground floor level only. A minimum distance of 3 m shall be maintained between such installation and public place, roadways, other surroundings and any building other than the one where LPG from the installation is intended to be used. The installation shall be protected from excessive weathering by sun, rain, etc. and from tampering by unauthorized persons. A lean-to roof with expanded metal on angle-iron framework on the sides are considered suitable for this purpose. In any case, adequate ventilation at ground level to the outside air shall be provided.

5.1.7 If the installation is more than 1 000 kg, installations in multiples of 1 000 kg with manifold, safety devices, change over mechanism may be provided with minimum inter distance of 2 m from all sides. Total number of such installations shall not exceed 8 including standby installation.

5.1.8 Cylinders shall be installed upright with the valves upper most.

5.1.9 Cylinder containing more than 20 kg of gas shall not be located on floors above ground level.

5.1.10 Cylinders shall be located on a concrete or brick floor, preferably raised in case of outdoor installations.

5.1.11 In order to prevent the hazardous collection of gas, cylinders shall be placed at least 1 m away from culverts, depressions, or openings leading to below ground level compartment and drains.

5.1.12 Cylinders which have safety relief valves or similar devices incorporated in them shall be so positioned so that if the relief device operates, escaping gas is not hazardous.

5.1.13 Cylinder installation for commercial/industrial/residential complexes, etc, or at any public place shall meet the following requirements:

- a) For commercial and industrial cylinder installation for any public places like mall, buildings, industries, hotels, etc, the sum total of all stationery installations inside the building shall not exceed 400 kg of LPG in any case. In case sum total of net weight of all the cylinders installed indoors exceed 400 kg provision for outdoor installations shall be made. For installations where the sum total is less than 400 kg of LPG provisions of 5.1.2 to 5.1.5 shall apply.
- b) For commercial and industrial cylinder installation for any public place, industry, etc, if the net weight of all the cylinders installed is more than 400 kg but less than 1 000 kg, then the installation shall be provided outdoors in line with 5.1.6. The cylinder installation shall be provided in a covered industrial shed but open from all sides for proper ventilation. In case the installed capacity increases

IS 6044 (Part 1) : 2018

more than 1 000 kg, then the installation shall be provided in line with 5.1.7.

- c) Cylinders shall not be installed at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety;
- d) Cylinders installation shall not be located along the drive way. Under unavoidable conditions, minimum distance of 3 m from drive way shall be maintained. Brick masonry (minimum 230 mm thick)/concrete (minimum 100 mm thick) walls or metallic Shields/barriers (minimum 1.63 mm sheet) and of minimum 2 m height shall be erected between drive way and cylinder installation for the safety and security of the installation;
- e) Cylinders shall be located on a concrete or brick floor that is firm, at level, smooth, drained in case of outdoor installation; and
- f) The cylinder shall be installed in upright position with the valve pointing upwards and away from any combustible materials.

NOTE — No installation shall be provided at basement or below ground level.

5.2 Portable Installations

When portability of cylinders is necessary, the following requirements shall be fulfilled:

- a) The sum total of capacity of the cylinders connected to each manifold shall not exceed 100 kg of LPG. The total quantity of gas thus installed in a workspace shall not exceed 200 kg.
- b) If cylinders are mounted on a trolley, the trolley shall be stable. Where necessary, the cylinders shall be secured to prevent them from falling.
- c) The regulator shall be connected directly to the cylinder valve or to a manifold which shall be connected to the cylinder valves by means of rigid connections to give adequate support to the regulator. The only exception to this requirement is where cylinders are mounted on a trolley and the manifold is rigidly supported on the trolley. In such a case flexible or semi-flexible connections may be used between the cylinder valves and the manifold but not between the manifold and the regulator.
- d) Anytime the total quantity of gas at portable installations shall be in proportion to the floor area as specified in 5.1.1 to 5.1.7.
- e) At any time the provision at 5.1.1 to 5.1.13 shall be ensured for all installations.

6 CYLINDER MANIFOLDS

6.1 All materials, fittings, etc, used in cylinder manifold systems shall comply with the statutory provisions or relevant Indian Standards. In absence of any such

provisions or Indian Standards, equivalent international standards shall be followed.

6.2 The individual component parts of manifolds, that is, piping, fittings, flexible hoses etc, which are subject to cylinder pressure shall be capable of withstanding a test pressure of 25 kgf/cm² or 1.5 times the developed pressure at 65°C, whichever is more, without bursting. Rubber hoses used shall conform to IS 9573 (Part 1).

6.3 Where cylinder installations are made up with service and reserve batteries of cylinders, suitable change-over devices or valves shall be incorporated in the manifold header to prevent undue escape of the gas when cylinders are changed.

6.4 In case PRV, manifold headers and automatic change-over devices are connected to cylinder by semi-flexible connectors, these shall be rigidly supported. Copper tube pigtails are considered to be semi-flexible for this purpose.

6.5 It is recommended that joints in manifold headers which do not have to be broken in normal use should be welded or brazed using a material which shall have a melting point of at least 540°C.

6.6 All joints between manifold headers and cylinder connectors shall be readily accessible.

6.7 All joints in the manifold should be welded (except for valve fixation) and be easily accessible for inspection/repairs, etc.

6.8 Each manifold arm shall be fabricated in such a way that minimum joints are provided. Only seamless pipes are recommended for use in manifolds. There should be a minimum gap of 300 mm between the manifold and valve protection ring of the LPG cylinders.

6.9 The cylinders connected to a manifold shall be safely spaced for easy and safe replacement of cylinder when empty. A minimum distance of 400 mm shall be maintained between two nipples provided on the manifold for connecting the cylinders to the manifold. In case of staggered arrangement of cylinders, a minimum distance of 150 mm shall be maintained between two nipples provided on the manifold.

In case, the diameter of the cylinder is higher than 400 mm, then the minimum distance between the two nipples shall be diameter of the cylinder plus 100 mm.

6.10 A pressure gauge of minimum dial size of 10 cm shall be provided in the manifold to indicate the gas pressure in the manifold. The pressure gauge shall be suitable for a pressure range 0 to 30 kgf/cm².

7 PRESSURE REGULATING DEVICE (PRV)

7.1 PRV and other devices used to control the gas shall comply with the relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international standards shall be followed.

7.2 If the PRV is fitted with a relief valve, care should be taken in positioning the regulator to avoid unnecessary hazards, if the relief valve functions.

7.3 PRV and other control devices shall be adequately supported.

7.4 The PRV installed shall be accessible for servicing and they shall be protected against any physical damage.

7.5 Venting

An independent vent to the outside of the building, sized in accordance with the manufacturer's instructions/distributing company's guidelines will be provided, where the location of a PRV is such that a ruptured diaphragm shall cause a hazard. Where more than one PRV is installed, then each PRV shall have separate vent to the outside. The vent shall be designed to prevent the entry of water, insects, or other foreign material that could block the passage. The height of the vent shall be 1.5 m above the eaves end of the shed or from the bottom of the roof. All vents connected to outlet of SRV, TRV etc., shall not be vented to the gas equipment flue or exhaust system.

7.6 Parallel PRV

Where uninterrupted supply is required two PRV, in parallel along with non-return valves, double isolation valves may be installed. Both PRV may be set at slightly different pressures so that one of the PRV shall act as a stand by.

7.7 Identification

When multiple PRV are installed in a building/system, then they shall be marked by a metal tag or other permanent means indicating the building or part of the building/gas utilizing equipment being supplied.

7.8 Over Pressure Protection Devices

Over pressure shut-off (OPSO) protection required to protect the downstream appliances from excessive pressure or the failure of the PRV shall be provided.

7.9 Under Pressure Protection Devices

Under pressure shut-off (UPS0) protection shall be provided in PRV near gas utilizing appliances. This shall shut-off gas flow in case of low pressure in the downstream gas supply.

8 PIPING, TUBING AND FITTINGS (EXCLUDING MANIFOLDS)

All piping, tubing and fittings shall comply with the relevant Indian Standards. In absence of any such provisions or Indian Standards, equivalent international standard shall be followed.

8.1 Copper Tube

Solid drawn copper tubes of outside diameter 10 mm, 12 mm or 20 mm, as suitable, conforming to IS 2501, shall be used. The wall thickness of the tubes shall be minimum 1 mm and suitable for withstanding 25 kgf/cm² pressure.

8.2 Steel Tubes

Cold drawn seamless, electric welded, cold drawn electric resistance welded (ERW) or oxyacetylene welded tubes of suitable sizes conforming to IS 3601 shall be used.

8.3 Mild Steel Tubes

Hot finished seamless, or electric resistance welded (ERW) mild steel tubes of suitable size, conforming to medium or heavy class of IS 1239 (Part 1), or any other steel tube approved by statutory authority shall be used.

8.4 The material used for flexible tubing and hose which are not subjected to full cylinder pressure shall be conforming to IS 9573 (Part 2).

8.5 The material used for shut-off valves and similar equipment which are not subjected to full cylinder pressure shall be such that, they shall withstand one and a half times the maximum working pressure to which they may be subjected in normal use.

8.6 Cast iron and aluminium fittings shall not be used.

8.7 In the case of flange connections, the flanges shall be machined and should preferably have raised face. Metallic/spiral wound metallic gasket of minimum thickness of 1.5 mm is preferable for use.

8.8 For any kind of movable appliance or burner, flexible connectors shall be used and they shall conform to IS 9573 (Part 2).

8.9 Emergency Shut-off Valve

A quarter turn emergency shut-off valve (ESOV) designed to work on LPG, shall only be used from a inline for shut-off operation. These are quick shut off valves like ball/plug valves. They should be installed as close as practicable to the point where gas enters the premises to which adequate access shall be provided. If it is installed inside the building it should be close to the entry point. In open position, the lever/key of the ESOV shall be in parallel to the axis of the pipeline on

IS 6044 (Part 1) : 2018

which it is installed. An emergency operating procedure shall be distinctly displayed near the ESOV.

8.10 Flanges

In case of flange connections, the flanges shall be machined and should preferably have raised face. For LPG lines subjected to full cylinder pressure of LPG liquid lines the minimum flange rating shall be 300 class rating.

8.11 Flange Gaskets

The acceptable materials for gaskets are metal or spiral wound metallic gaskets. Whenever flange connection is opened, gasket shall be replaced. For liquid lines, only spiral wound metallic gaskets shall be used.

8.12 Used Pipes, Fittings

Pipe, fittings, valves or other materials can be re-used subject to conforming all the requirements prescribed in this standard.

9 I NSTALLATION OF PIPING AND VALVES

9.1 Flexible Hose

9.1.1 Installations on which flexible hose is used shall satisfy the following conditions:

- a) Cylinder and the appliances connected to it shall be in the same room/shed;
- b) Length of hose shall be kept as short as possible and should normally not exceed 2 m; and
- c) Appliances connected shall be of portable type and not mounted in a fixed position.

9.1.2 Flexible hose shall not be extended from one room or verandah or one space to another and, therefore, shall not be passed through doors, windows, walls, partitions, ceilings, or floors.

9.1.3 Flexible hose shall be accessible for easy inspection and shall not be connected from hole in walls, cupboards, cabinets and other obstructions.

9.1.4 Flexible hose shall not be used in conditions where ambient temperature exceeds 52°C.

9.1.5 Flexible hose shall be so installed that it is not twisted, looped or kinked and is not subjected to any external pressure.

9.2 Appliances which are rigidly fixed in position shall be connected by means of rigid piping.

9.3 Appliances which are portable, if connected to rigid piping, shall be connected through flexible or semi flexible connections.

9.4 Cylinder Pigtailes

The hose used for connecting the cylinders with manifold as well as at any part of the piping which is

subjected to full cylinder pressure shall be conforming to IS 9573 (Part 1). The free nut at the end of pig tail shall be of non-corrosive metal.

9.5 Adaptor

If an adaptor is used to connect the pigtailes to the cylinder valves (self-closing) of the LPG cylinders, then it shall have non-return valve (NRV).

9.6 Pressure Gauge

A pressure gauge with a range of 0-5 kgf/cm² shall be provided in the pipeline after the first stage PRV. The joint at which pressure gauge is fixed shall be thoroughly checked for leakage. Milibar pressure gauges (0-500 mili-bar) shall be provided in the pipelines after second stage PRV.

9.7 Excess Flow Check Valve

The excess flow check valve shall be provided on each arm of the manifold to ensure stoppage of LPG supplies in case of heavy leakage/damage to the pipeline in the downstream facilities. The capacity of the excess flow check valve shall be +10/-20 percent of designed flow rate.

9.8 Piping

9.8.1 Piping (internally and externally) shall be free of cutting burrs, loose scales, dirt, dust and other foreign matter before the installation.

9.8.2 Wherever possible, joints should not be placed beneath ground level in inaccessible places, confined places (for example cellars), air or ventilating ducts, space under flooring or lift shafts.

9.8.3 If joints have to be used in piping beneath ground level in inaccessible places or confined places, they shall be welded or brazed to minimize the risk of leakage which may lead to collection of hazardous gas.

9.8.4 Where welded or brazed joints are used, they shall be of adequate mechanical strength, and the material used for welding or brazing shall have a minimum melting point of 540°C.

9.8.5 Joints other than welded or brazed shall be readily accessible.

9.8.6 Piping shall be so located or protected so as to avoid extremes of temperature which might give rise to condensation or cracking of the gas.

9.8.7 Provision shall be made to avoid damage to the piping from its expansion, contraction and vibration and by settlement of the building by which it is carried.

9.8.8 Piping shall be protected against corrosive atmospheres and materials.

9.8.9 As far as possible, concealed piping shall be avoided. If concealed piping is used, it shall be

IS 6044 (Part 1) : 2018

protected against inadvertent damage, such as from nails and knocks, by its location, type of material used or sheathing.

9.8.10 Piping shall not be run in or through an air or ventilating duct, chimney, flue or lift shaft.

9.8.11 Piping up to an outside diameter of 12 mm shall be supported at intervals of about 50 cm by means of pipe saddles or clamps in a way to avoid sagging and shifting. For larger diameter pipes, suitable longer supporting intervals may be used.

9.8.12 It is recommended that if the pipes are run along a surface of a structure, the supports should be so designed that the joints are sufficiently clear of the surface to permit the use of tools without damage to the surface.

9.8.13 It is recommended that when installing pipes along a surface of a structure, the installation is done in such a way that moisture is not trapped between the surface and the pipeline.

9.8.14 It is recommended that the piping passing through walls should be protected by a covering sleeve. If it is necessary to pack the space between the piping and the sleeve, a moisture-proof material which does not corrode the piping shall be used.

9.8.15 The distance between gas piping and electrical wiring system shall be at least 600 mm and, where necessary; they shall be securely fixed to prevent contact due to movement. The gas piping should run below the electrical wiring.

9.8.16 The distance between the gas piping and steam piping, if running parallel, shall be at least 150 mm. The gas piping should preferably run below the steam piping.

9.9 Suitable line shut-off valves shall be fitted for each appliance or burner.

9.10 A main valve shall be fitted in the piping as near as possible to its point of entry into building with proper sealing arrangement.

9.11 It is recommended that the number of fittings used in an installation should be kept to a minimum in order to reduce the risk of gas leakage. As far as possible, straight lengths of piping should be used. Where there are bends in the pipeline, these should have a radius of at least five times the diameter of the pipe.

9.12 The open ends of piping and fittings (with the exception of terminal taps or valves in regular use) shall always be made gas-tight by means of either an appropriate terminal fitting or a plug, welded or brazed in position. Welding or brazing material shall have a melting point of at least 540°C.

9.13 The distribution pipeline in residential buildings shall always be laid on walls with proper cleat supports/hanged from the roofs with adequate clearance from wall surface so that surface preparation and painting will be easier. The piping shall be anchored to prevent undue

strains on connected equipment and shall not be supported by other piping. The spacing of supports in gas piping installations shall not be greater than 1.8 m for 12 mm/15 mm dia pipe, 2.4 m for 20 mm/25mm dia pipe, 3 m for 40 mm dia pipe and above.

9.14 The pipeline connecting the storage shed to the main installation should preferably be brought overhead without creating any hazard for the people/vehicles passing through the same. In case of any foreseen hazard the pipeline can be laid underground in a trench filled up with sand of grading zone IV as per IS 383 having MS/RCC cover. The underground pipe shall be provided with adequate protection like wrapping coating, etc, for protection against corrosion.

9.15 The single stage pipeline network (down the range of first stage PRV) from the installation onward should work at pressure very close to the working pressure of the appliances. Under no circumstances, the pressure of the pipelines shall exceed 1.5 kg/cm². This should be obtained by double stage regulation of pressure, if necessary.

10 LEAKAGE TESTING

10.1 Before any system of gas piping is finally put into service, it shall be carefully tested as per **A-8.3** of Annex A to ensure that it is gas-tight. Where any part of the system is to be closed or concealed, the test shall precede the work of closing in.

10.2 Naked flames shall never be used for checking gas-tightness of the installations.

10.3 It is recommended that the location of leaks should be detected by the use of soap solution or similar materials.

10.4 Defective pipes or fittings shall be replaced and shall not be repaired *in-situ*.

10.5 Electronic gas leak detectors duly approved by statutory authority along with control panel for giving audio/visual alarms shall be used for leak detection especially in commercial/industrial installations and in domestic/residential housing complexes, where combined capacity of all installations is exceeding 1 000 kg or where reticulated system has been provided.

11 MAINTENANCE

11.1 The distribution company shall design an elaborate work permit format for the maintenance work which

IS 6044 (Part 1) : 2018

shall be used by the service provider for carrying out any maintenance work. It shall be the responsibility of the service provider to make necessary inspection in line with the work permit before commencement of the work.

11.2 The user shall get the inspection of the cylinder manifold, distribution piping, safety system, equipment, valves fittings, auto change over system, gas monitoring system, hydrant hoses, etc, regularly as per the periodicity defined by the Distributing Company. However, minimum periodicity of inspection shall be once a year and the records have to be maintained. The inspection shall include checking the health, performance of all equipment like valves, PRV, auto change over system for proper operation (wherever installed), underground piping, etc. Work permit system developed by the LPG distribution company shall be followed.

11.3 The repair, maintenance of any defective piping, manifold or any other equipment has to be carried out by agencies approved by the LPG distribution company or distributing company itself.

11.4 Pneumatic testing and hydro testing of piping shall be done once in five years by agencies approved by distribution company.

11.5 All PRV shall be throttled once a year for its accurate throttled pressure and safe operation.

11.6 The pigtails shall be checked visually every time when empty cylinder is replaced.

11.7 Hydro test of pig tails and flexible LPG hoses shall be carried out on yearly basis.

11.8 The distribution company shall conduct a safety awareness camp for the consumers particularly for residential and commercial consumers.

11.9 A fire hydrant line wherever provided, shall be in the vicinity of the installation and a hydrant point with hoses to take care of any exigency or emergency situation.

12 INSTRUCTIONS TO CONSUMERS

12.1 Consumers shall be instructed by the distribution company on the following aspects:

- a) Operation of the whole system;
- b) How to recognize gas leaks;
- c) Action to be taken in case of leakage;
- d) Action to be taken in case of fire; and
- e) Action to be taken in case of damage to, or failure of, any part of the installation.

12.2 Part of the Installation working at cylinder pressure to be tested at 25 kgf/cm² or 1.5 times the developed pressure at 65°C, whichever is more, once in a year.

12.3 Downstream part of the installation after PRV to be tested at one and a half times the maximum outlet pressure that may be given by an adjustable PRV or 2 kgf/cm², whichever is more, once in a year

12.4 Portions of installation not subjected to cylinder pressure but carrying gas at pressure more than 30 gf/cm² to be tested at 2.5 times the working pressure for 2 min, once in a year

12.5 Portions of installation subjected to gas pressure of 30 gf/cm² or less, to be tested at 2.5 times the working pressure for 2 min, once in a year.

12.6 Handling and Use

- a) Cylinders shall be adequately supported during handling and shall not be dropped or should not be allowed to fall upon one another.
- b) Trolleys and cradles of adequate strength shall as far as possible be used when moving the cylinders.
- c) Use of high powered magnets for lifting the cylinders and chains for slinging the cylinders shall not be permitted.
- d) No lubricant should be used on the valve or any other fitting on the cylinder.
- e) Open flames, lights, lighting of fires, welding and smoking shall be prohibited in close proximity.

ANNEX A

(Clause 1.2)

REQUIREMENTS OF LIQUID OFF TAKE VALVE MULTI CYLINDER INSTALLATION

A-1 GENERAL

- a) The liquid withdrawal or liquid off take (LOT) valve (*see* IS 16484) multi cylinder installation shall meet the requirements given in IS 6044 (Part 2) and this standard.
- b) The cylinder and valve used for liquid off take shall be approved by statutory authority.
- c) For any additional cylinders which are to be kept loose, the customer can store them within stipulations as provided for in *Gas Cylinders Rules*, 2016.
- d) The manifold and the LOT valve installation shall be certified by the officer of the distributing company or third party inspection agency recognized by distribution company prior to commissioning.

A-2 LAYOUT

- a) The site for LPG cylinder manifold shall be located away from the furnace, any source radiating heat like steam pipes and boilers, etc, to prevent cylinders from getting affected due to radiant heat.
- b) The area where this installation is provided shall:
 - 1) be a segregated area with all round fencing as per 5.1.13c) and plain cement flooring/paver block in the open space inside the fenced area. The plain cement flooring / paver block shall be raised by minimum 100 mm from the natural ground; and
 - 2) have mastic flooring inside the shed, raised by minimum 100 mm from plain cement flooring/paver block. The cylinders shall be stored in dry, cool and well ventilated shed.
- c) The cylinder installation area and the area where vaporizer is installed shall be a covered shed with sides open for ventilation. Flammable materials like wood and plastic shall not be stored in this area. Flame proof (FLP) light fitting approved by the Statutory Authority for lighting with armoured aluminium/copper PVC extruded cable with fire retardant properties conforming to relevant Indian Standards shall be provided.
- d) The cylinder shall be installed in upright position with the valve pointing upwards.
- e) The cylinder installation should be so located so as to facilitate the following:
 - 1) Full and empty cylinders can be easily changed, disconnected and removed quickly at the time of normal operation or emergency.

- 2) It is easy to operate and maintain the valve provided between the manifold and the cylinder.
- 3) Manifold maintenance is easier.
- 4) Cylinders shall not be installed below ground level in cellars or basement or at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety.
- f) Since LPG is heavier than air, proper ventilation shall be provided at floor level open to atmosphere.
- g) Main shut-off valve (Plug or ball-type) on the pipeline emerging out of cylinder installation area shall be located in such a manner that it just falls outside the cylinder installation area and shall be easily accessible at all times. At the point of entry of each work place, the line shall have a quick shut-off valve (plug or ball-type).
- h) Wherever the pipelines are passing through walls, slacks shall be provided so that the pipeline does not get a braised.
- j) A minimum distance of 1 m shall be maintained between the cylinder installation and the surface water drain, if any.

A-3 INSTALLATION

Following provisions, in addition to requirements given in IS 6044 (Part 2), and this standard are to be made for LOT valve installation:

- a) A safety valve, thermal relief valve, excess flow check valve and non-return valve shall be provided on liquid line as shown in Fig. 1 (for illustration). SRVs may be inter-connected through a common vent flow which shall be at a height of minimum 1.5 m above eaves end of the shed.
- b) The safety relief valves shall be as per IS 12992 (Part 1) and have adequate capacity.
- c) The vent of the safety valve/thermal relief valve shall be at a height of minimum 1.5 m above eaves end of the shed. It shall be adequately supported. A thermal relief valve is required to be provided between two isolation valves in the liquid pipeline.
- d) The name plate shall be provided on the piping manifold assembly containing the following information:
 - 1) Name of the owner;
 - 2) Type of installation;
 - 3) Installation date;

IS 6044 (Part 1) : 2018

- 4) Date of test and test pressure, in kg/cm^2 ; and
 - 5) Manufacturer's identification symbol.
 - e) The typical installation layout, piping and distance is provided in Fig. 1 to Fig. 6 as directional guidelines for installation up to 8000 kg capacity. Any modifications and changes shall be as accepted by the distribution company.
- ### A-4 PIPE AND PIPE FITTINGS FOR PIPING MANIFOLD AND HEADER UP TO PRV
- a) The pipe fittings used shall be forged fittings of SCH 80, as per specifications approved by the distributing company.
 - b) All fittings of less than 50 NB shall also be forged fittings of 300 class rating.
 - c) The pipe used for liquid line that is upto vapourizer shall be seamless steel pipes as per specifications accepted by distribution company. Pipes of below 50 NB shall be of SCH 80 and pipes of 50 NB and above shall be of SCH 40. Copper tubing manifolds shall not be allowed. The pipe used for vapour service (after vapouriser) shall be as specified in 8.
 - d) No screwed connection shall be allowed. In case, due to any reason screwed connection is used, the pipe used shall be of SCH 80 only.
 - e) The valves, sight flow indicator, thermal relief valve, NRV, etc, shall be of 300 class rating. Only cast steel ball valves with fire safe feature shall be used.
 - f) All flanges used shall be of carbon steel, SA105, 300 class rating with dimensional standard as per specifications approved by distribution company. No screwed connections should be provided except for the special fitting as specified in 4.4.
 - g) All weld joints provided on the line shall be accessible and shall be hydro-tested for $25 \text{ kgf}/\text{cm}^2$ pressure. The welding shall be fusion welding.
 - h) Only metallic/spiral wound metallic gaskets shall be used for liquid line that is up to vapourizer and also down stream of vapourizer.
 - j) Each arm of the manifold shall have a control valve. To each arm of the cylinder manifold, cylinders shall be connected through a pigtail. A check valve and an isolation valve shall be

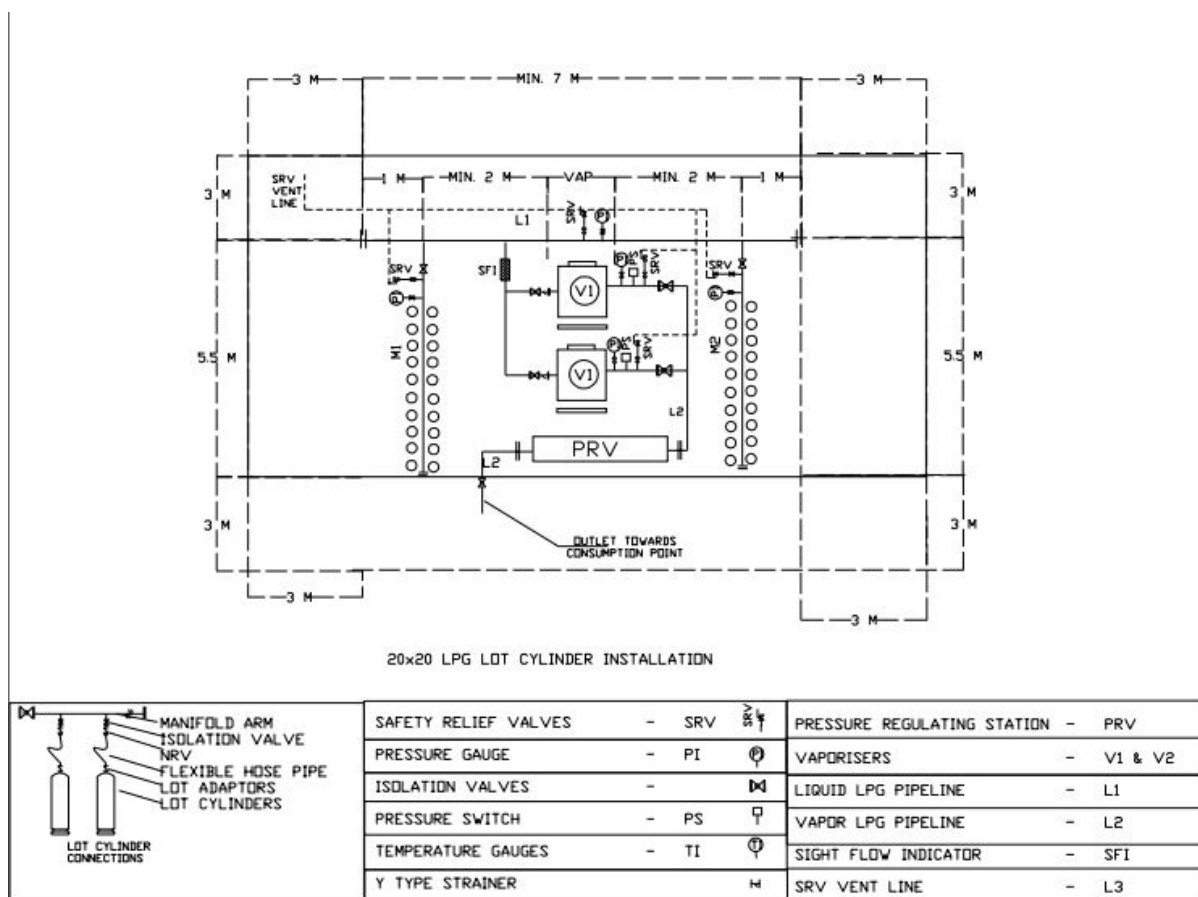


FIG. 1 TYPICAL ILLUSTRATION FOR INSTALLATION AND PIPING LAYOUT
FOR 20 × 20 LPG LOT CYLINDER INSTALLATION

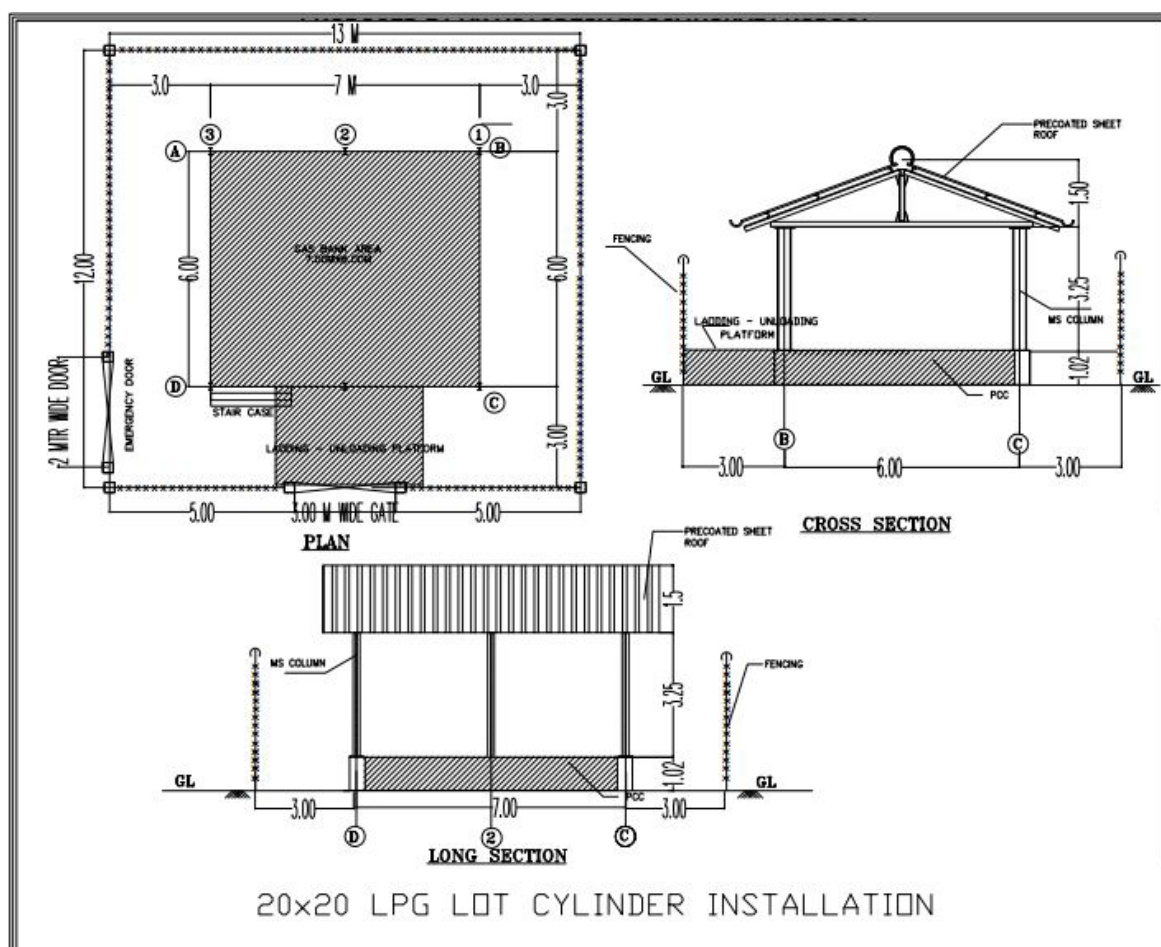


FIG. 2 TYPICAL ILLUSTRATION FOR INSTALLATION LAYOUT AND DISTANCE FOR 20 × 20 LPG LOT CYLINDER INSTALLATION

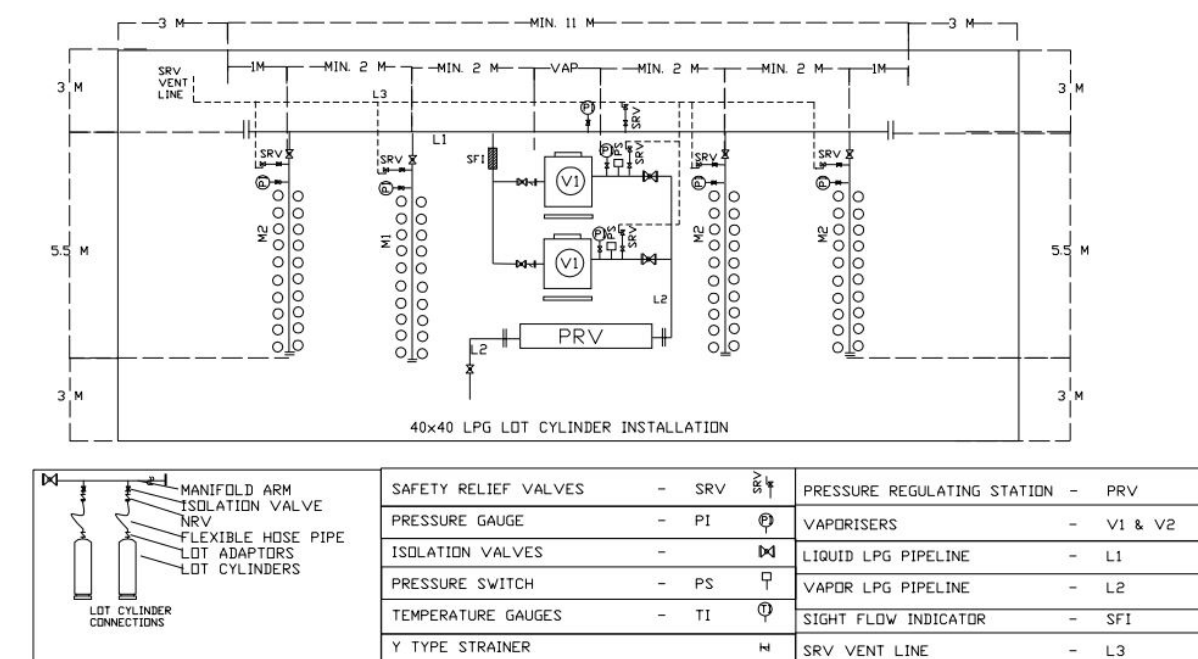


FIG. 3 TYPICAL ILLUSTRATION FOR INSTALLATION AND PIPING LAYOUT FOR 40 × 40 LPG LOT CYLINDER INSTALLATION

IS 6044 (Part 1) : 2018

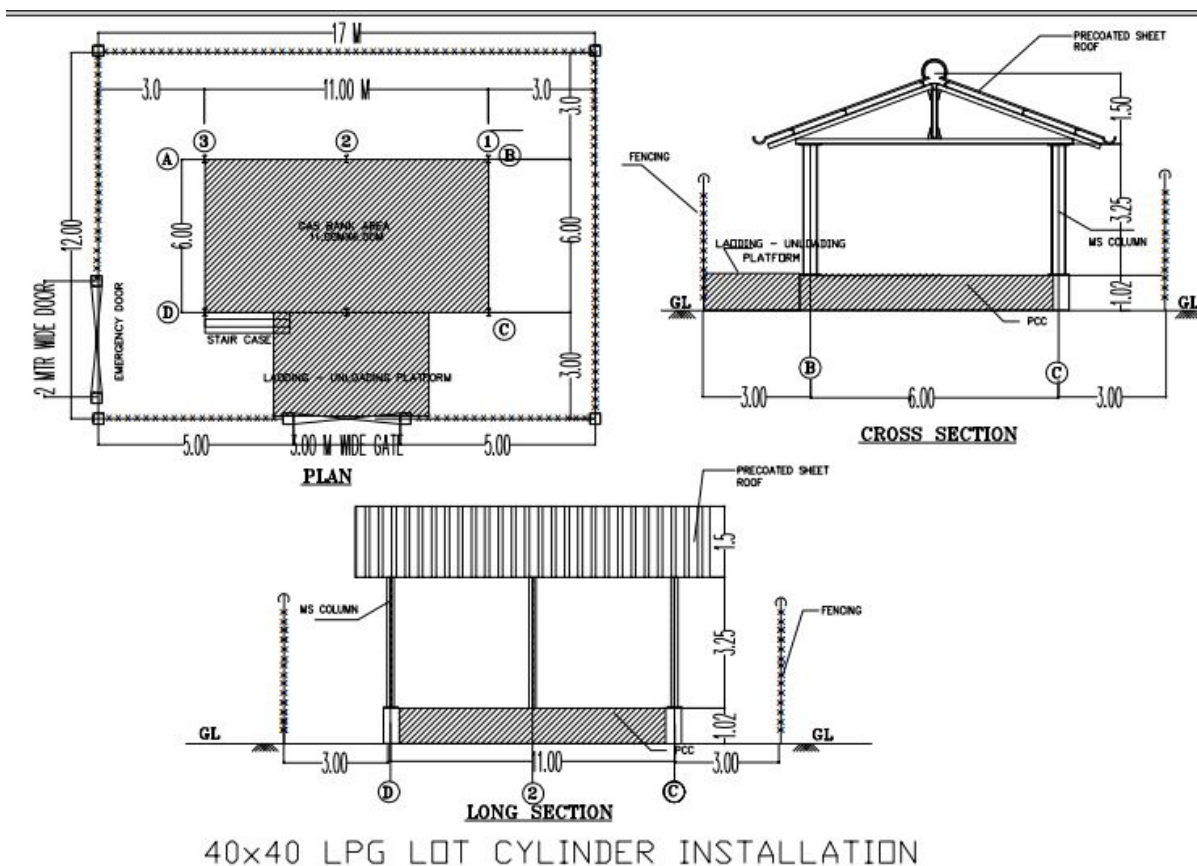


FIG. 4 TYPICAL ILLUSTRATION FOR INSTALLATION LAYOUT AND DISTANCE FOR 40 × 40 LPG LOT CYLINDER INSTALLATION

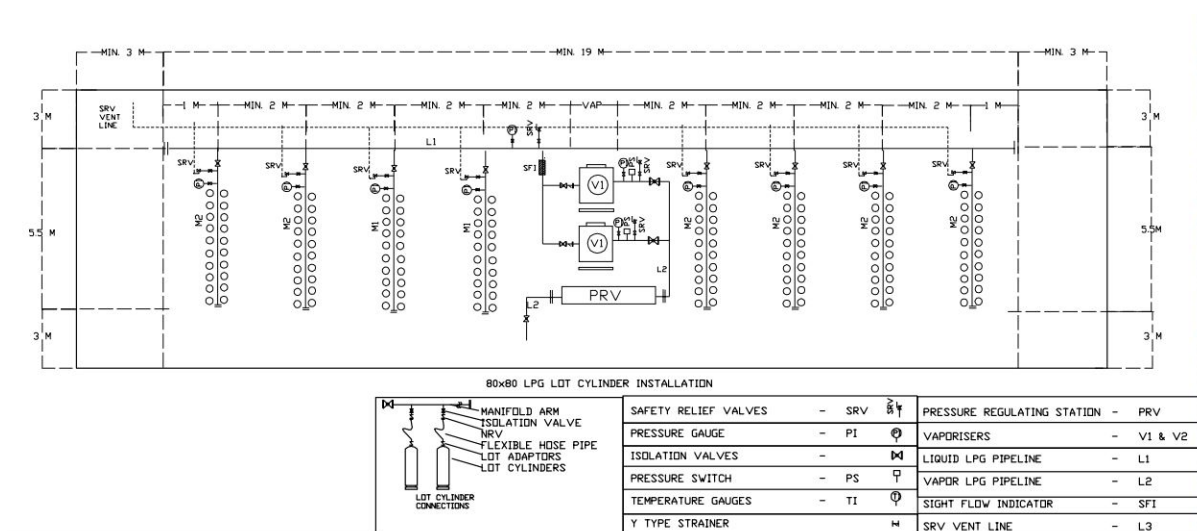
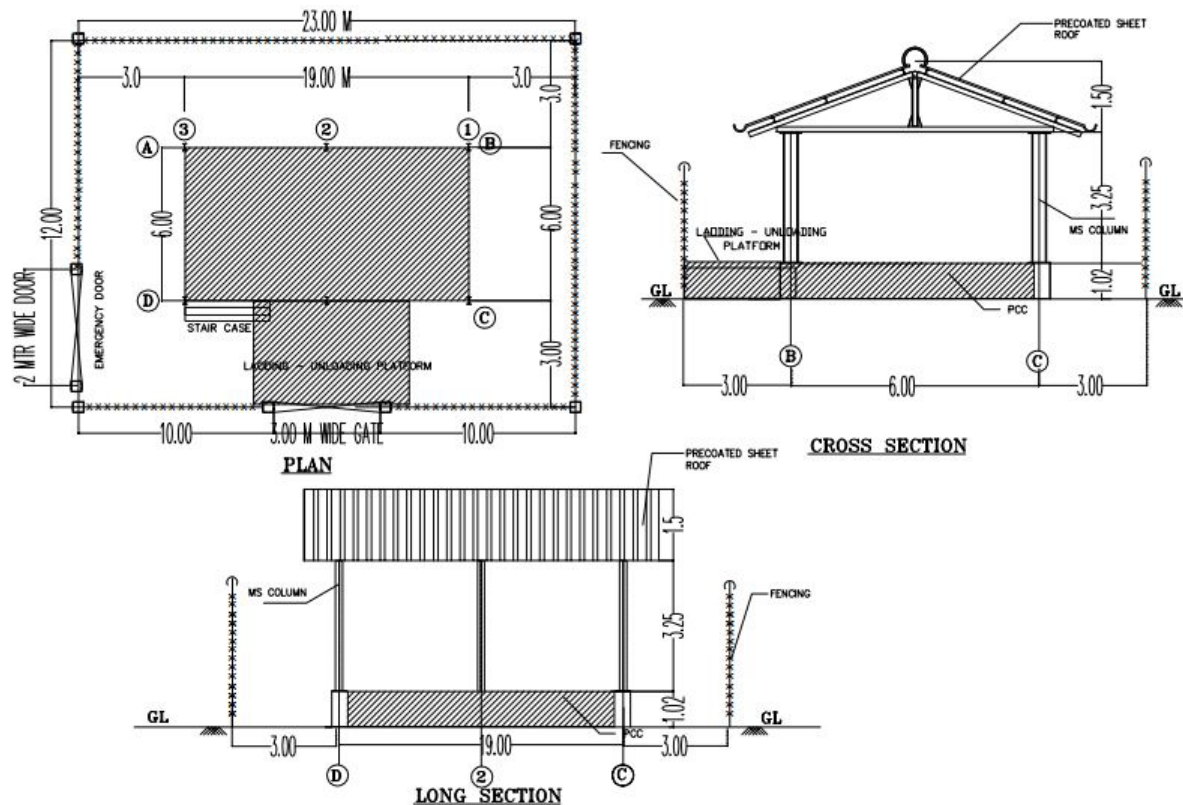


FIG. 5 TYPICAL ILLUSTRATION FOR INSTALLATION AND PIPING LAYOUT FOR 80 × 80 LPG LOT CYLINDER INSTALLATION



80x80 LPG LOT CYLINDER INSTALLATION

FIG. 6 TYPICAL ILLUSTRATION FOR INSTALLATION LAYOUT AND DISTANCE
FOR 80 × 80 LPG LOT CYLINDER INSTALLATION

- provided with each cylinder pigtail connection to protect the system from back flow of LPG in event of any flexible pigtail rupture. The distance between two pigtail connections on manifold shall be minimum 300 mm.
- k) Cylinder manifold is subjected to full cylinder pressure at all times. The fabrication/welding of the manifold should be of the best available quality. All such manifolds shall be designed to a pressure equivalent to the maximum developed cylinder pressure (assessed at 65°C) of LPG that is 16.87 kgf/cm². The test pressure should be 1.5 times the maximum pressure (assessed at 65°C) that is 25 kgf/cm² for a period of 2 min.
 - m) **Painting** — Piping manifolds and the supporting structure shall be painted with two coats of red oxide primer and with two coats of first quality synthetic enamel paint. The colour of the LPG lines shall be as per IS 2379.

A-5 VAPOURIZER

- a) The vapourizer used shall be approved by statutory authority. Vapourizers may be low pressure steam heated, hot water heated, electrically heated type

or heater less. In case electrical vapourizer is used, it shall have FLP connections.

- b) A minimum distance of 2 m of vapourizer from cylinder installation shall be maintained.
- c) The vapourizers shall be provided with suitable automatic means to prevent liquid LPG passing from the vapourizer to gas discharge piping.

A-6 FLEXIBLE HOSE

- a) The hoses connecting cylinder with manifold shall be in line with IS 6044 (Part 2), and shall be used for connecting the cylinder to manifold. The hoses shall be as per IS 9573 (Part 1) The hoses shall be hydro tested at 25 kg/cm² pressure once in six months.
- b) The design, material and construction of hoses shall be suitable for grade of LPG. Currently, it is envisaged that LPG as per IS 4576, shall be supplied.
- c) The flexible hoses should have electrical continuity of 0.75 Ω/m.
- d) All flexible hoses used before first stage PRV and after second stage PRV shall be tested at 3.5 MPa (35 kgf/cm²) during initial manufacture

IS 6044 (Part 1) : 2018

and should be designed to withstand a minimum bursting pressure off our times the maximum working pressure.

- e) The flexible hose/pigtail shall be in the same room and its length shall not exceed 2 m. Flexible hose/pigtail shall not pass through doors, windows, walls, ceiling (or) floors. The pigtails shall be accessible for inspection.
- f) In case the ambient temperature exceeds 52°C, flexible hose shall not be used.
- g) The flexible hose shall not be twisted, looped or kinked. It should not be subject to any external pressure.
- h) The hose shall be tested half yearly and proper records of testing, etc, shall be maintained.

A-8 SAFETY AND INSPECTION

- a) The consumer has to be trained to use the LOT cylinder installation. A trained personnel who has minimum qualification as diploma in engineering or a science graduate at supervisory level shall be responsible for the installation from customer's end. However for daily operation of connecting and disconnecting the cylinders and for other operation a trained ITI technician is preferred.
- b) Distributing company shall assist the consumer in organizing regular safety programmes, drills, etc, and will also provide regular training on use of LPG.
- c) Empty cylinders shall be placed in a safe place and proper safety cap shall be provided on the valve so as to ensure that no leakage takes place.

A-8.1 Maintenance of Cylinder Manifold

Maintenance of the cylinders manifold and the equipments shall be undertaken regularly and the periodicity of the maintenance shall be as under:

A-8.1.1 Periodicity of Checks and Maintenance

- a) *Valves*
 - 1) All the valves that is safety valves, TRV shall be checked once a year.
 - 2) All the other valves should be checked once a year for free and full range of movement, positive shut off, mechanical damage, etc.
- b) *Piping and manifold*
 - 1) It should be checked once a year visually for corrosion, any physical damage. All supports of manifold should also be checked for any corrosion, etc.
 - 2) The manifold should be internally cleaned once a year and should be free from contaminants.
 - 3) The strainer provided on the manifold should be cleaned at least once in a month.

- 4) Hydro testing of manifold and pneumatic testing of pipelines should be done once in 5 years.

- c) Vapourizer shall be checked as per maintenance schedule.
- d) The burners shall be regularly cleaned.
- e) Pigtails shall be checked every time empty cylinder is replaced by a filled cylinder and replaced in case of any physical damage.
- f) The PRV should be checked once in a year for correct settings and performance as well as for corrosion and mechanical damage.
- g) The pressure gauges should be calibrated once in a year and proper records should be maintained. The dial of the gauge should be clearly visible.

A-8.2 Inspection

- a) All the manifold installations shall be checked once in six months by the authorized agency or the LPG distributing company and record to be maintained at the installation location.
- b) The installation shall be checked once in a year by the sales officer of the LPG distributing company or by their authorized third party inspection agency.
- c) The area of LOT installation should be free of any uncontrolled weed growth and accumulation of waste products.

A-8.3 Leak Testing

- a) It shall be ensured that the manifold provided has been subjected to the hydro test pressure of 25 kgf/cm² atleast for a minimum period of 30 min and inspected by the authorized agency or the distribution company.
- b) It shall be ensured that the fire extinguishers and sand buckets are provided and installations are adequately protected from weather conditions.
- c) The gas piping system should be carefully tested for ensuring gas tightness.
- d) Naked flames shall never be used for checking gas tightness of the installation.
- e) Leak detection should be done using soap solution or similar material.
- f) All defective pipes should be replaced and no repair should be carried out *in-situ*.

A-8.4 Warning Signals

- a) Smoking or naked flames shall not be permitted within the Safety Zones of the installation. 'NO SMOKING', 'HIGHLY INFLAMMABLE GAS', 'DANGER', boards shall be provided.
- b) Sign boards, instruction boards for 'DOs' and 'DONTs' shall be provided.

IS 6044 (Part 1) : 2018

- c) Instruction board with emergency telephone numbers and important telephone numbers shall be provided.
- d) Instruction board prohibiting unauthorized entry shall be provided.
- e) It shall be ensured that all signage are in place and are legible.

A-8.5 Source of Leakages

- a) *Cylinders*:
 - 1) Welded seams;
 - 2) The cylinder/valve connection bung joint; and
 - 3) Cylinder valve.
- b) *Check Leakage from PRV at*:
 - 1) Near the joints;
 - 2) In the PRV itself;
 - 3) Check leakage from the piping and manifold PRV;

A-8.6 Action to be Taken when Leakage is Detected

- a) *Leakage of Cylinder* — Any cylinder which develops a leak should be promptly removed to an isolated open place away from any source of ignition.
- b) In case of leakages of piping, appliances or pressure regulators, close the valves and isolate the part, disconnect the cylinders and place the

safety cap on the valve of the cylinder. Never repair the appliance or any other part of system when in use.

- c) The matter should be immediately reported to the in charge and the officer of distribution company.

A-9 EARTHING AND ELECTRICAL PROTECTION

- a) The cylinder manifold installation, the vapourizer installation and the downstream installation shall be earthed at two places. Two earth pits as per IS 3043, shall be provided and the earthing resistance should not exceed 1Ω .
- b) The system should be tested for electrical continuity and resistance to earth.
- c) The earthing resistance shall be checked twice a year once during the summer season and once during winter and records for same shall be maintained.
- d) Only flame proof electrical fittings approved by statutory authority shall be used in the area segregated for LOT installation. These shall be earthed at two points:
 - 1) Only flame proof hand torches shall be used; and
 - 2) Copper jumpers shall be provided at flange.

IS 6044 (Part 1) : 2018

ANNEX B

(Foreword)

COMMITTEE COMPOSITION

Gas Cylinders Sectional Committee, MED 16

<i>Organization</i>	<i>Representative(s)</i>
Petroleum and Explosive Safety Organization, Nagpur	SHRI N. T. SHAHU (Chairman) SHRI ASHENDRA SINGH (<i>Alternate</i>)
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IS 6044 (Part 1) : 2018

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